AMENDMENTS TO THE CLAIMS

The claims relating to the above-captioned patent application, as amended herein and with the status thereof, are as follows:

1. (currently amended) A method for making a surface micromachined microstructure, comprising the steps of:

forming a first sacrificial layer over a first substrate, wherein said first substrate comprises an upper surface that extends in a lateral dimension ~~is at least generally parallel with an upper surface of said first substrate~~;

forming a plurality of ~~discrete and at least generally laterally extending hollow~~ conduits that are hollow, embedded, have a closed perimeter that ~~are~~is defined at least in part by said first sacrificial layer, and extend in said lateral dimension;

forming a first structural layer over said first sacrificial layer and after said forming a first sacrificial layer step, wherein said first structural layer extends in said lateral dimension and comprises a first perimeter that defines a lateral extent of said first structural layer, wherein said plurality of conduits extend in said lateral dimension underneath said first structural layer such that said first structural layer overlies said plurality of conduits, wherein at least one end of at least one of said plurality of conduits is at a location in said lateral dimension that at least generally corresponds with a location in said lateral dimension of a corresponding portion of said first perimeter; and

removing said first sacrificial layer after said forming a first structural layer step, wherein said removing step comprises flowing an etchant within at least some of said plurality of conduits.

2. (original) A method, as claimed in Claim 1, wherein:

each of said forming a first sacrificial layer step and said forming a first structural layer step is selected from the group consisting of chemical vapor deposition, thermal oxidation processes, physical vapor deposition, and any combination thereof.

3. (original) A method, as claimed in Claim 1, wherein:

said forming a plurality of conduits step comprises:

forming a first intermediate layer on said first sacrificial layer before said forming a first structural layer step, whereby said first intermediate layer is thereby disposed somewhere between said first structural layer and said first substrate;

patterning said first intermediate layer into a first subassembly;

etching only an upper portion of said first sacrificial layer after said patterning step, wherein said etching step comprises forming undercuts beneath edge portions of said first subassembly; and

forming a second sacrificial layer at least on said first sacrificial layer, wherein said forming a second sacrificial layer step is executed after said etching step, and wherein said forming a second sacrificial layer step fails to fill said undercuts and which thereby defines said plurality of conduits.

4. (original) A method, as claimed in Claim 3, wherein:

said forming a first intermediate layer step comprises forming a first intermediate structural layer.

5. (original) A method, as claimed in Claim 3, wherein:

said first subassembly remains after said removing step.

6. (original) A method, as claimed in Claim 3, wherein:

said forming a second sacrificial layer step further comprises forming said second sacrificial layer on and over an entirety of said first subassembly.

7. (currently amended) A method, as claimed in Claim 6, further comprising the ~~step(s)~~ steps of:

planarizing an upper surface of said second sacrificial layer; and

etching entirely through said second sacrificial layer to said first subassembly to define a first interconnect aperture assembly in said second sacrificial layer that exposes said first subassembly, wherein said forming a first structural layer step comprises depositing a structural material both within said first interconnect aperture assembly and on top of said second sacrificial layer.

8. (original) A method, as claimed in Claim 7, wherein:

a pattern of said first interconnect aperture assembly in said second sacrificial layer at least generally matches a pattern of said first subassembly.

9. (original) A method, as claimed in Claim 7, wherein:

said first interconnect aperture assembly comprises a plurality of separate and discrete holes that are disposed in spaced relation to each other.

10. (original) A method, as claimed in Claim 7, wherein:

said first subassembly comprises a plurality of laterally extending strips.

11. (original) A method, as claimed in Claim 7, wherein:

said planarizing step comprises chemical mechanical polishing.

12. (original) A method, as claimed in Claim 7, wherein:

said forming a first structural layer step comprises forming a depression on an upper surface of first structural layer which is vertically aligned with where said structural material was deposited within said first interconnect aperture assembly, and wherein said method further comprises the step of planarizing said upper surface of said first structural layer.

13. (original) A method, as claimed in Claim 6, wherein:

said forming a first structural layer step is executed after said forming a second sacrificial layer step, whereby said second sacrificial layer a disposed somewhere between said first structural layer and said first substrate, said method further comprising the step of:

structurally interconnecting said first structural layer and said first subassembly through said second sacrificial layer and before execution of said removing step.

14. (original) A method, as claimed in Claim 3, wherein:

each of said first structural layer and said first intermediate layer consist of polysilicon.

15. (original) A method, as claimed in Claim 3, wherein:

said removing step further comprises removing said first subassembly using said etchant.

16. (original) A method, as claimed in Claim 15, wherein:

a maximum thickness of said first subassembly is about 1500 Å.

17. (original) A method, as claimed in Claim 15, wherein:

said first subassembly consists of silicon nitride.

18. (original) A method, as claimed in Claim 3, wherein:

said first subassembly consists of a plurality of at least generally laterally extending strips.

19. (original) A method, as claimed in Claim 3, wherein:

said forming a first structural layer step is executed after said forming a second sacrificial layer step, whereby said second sacrificial layer is disposed at least somewhere between said first structural layer and said first substrate.

20. (original) A method, as claimed in Claim 3, wherein:

said removing step further comprises removing second sacrificial layer.

21. (original) A method, as claimed in Claim 1, further comprising the steps of:

forming a first intermediate layer between said first sacrificial layer and said first structural layer, whereby said first intermediate layer is disposed at least somewhere between said first sacrificial layer and said first structural layer;

patterning said first intermediate layer into a plurality of at least generally laterally disposed and axially extending strips that are disposed in at least substantially parallel and equally spaced relation, wherein a maximum spacing between adjacent pairs of said plurality of strips is about 1.5 microns, and wherein a minimum thickness of each of said plurality of strips is about 1.5 microns;

forming said first sacrificial layer over said first intermediate layer, wherein said forming said first sacrificial layer step fails to fill an entirety of said spacing between said adjacent pairs of said plurality of strips and which thereby defines said plurality of conduits.

22. (original) A method, as claimed in Claim 1, wherein:

said forming a plurality of conduits step is executed before said forming a first structural layer step.

23. (original) A method, as claimed in Claim 1, further comprising the step of:

forming at least one intermediate sacrificial layer and at least one intermediate structural layer between said first sacrificial layer and said first substrate.

24. (original) A method, as claimed in Claim 1, wherein:

said first structural layer is free of any aperture which at any time extends entirely downwardly through said first structural layer.

25. (original) A method, as claimed in Claim 1, wherein:

said first structural layer is movable relative to said first substrate after said removing step.

26. (currently amended) A method, as claimed in Claim 1, wherein:

said forming a plurality ~~of discrete and at least generally laterally extending hollow~~ conduits step comprises disposing said plurality of ~~hollow~~ conduits in non-intersecting relation.

27. (currently amended) A method, as claimed in Claim 1, wherein:

said forming a plurality ~~of discrete and at least generally laterally extending hollow~~ conduits step comprises disposing said plurality of ~~hollow~~ conduits in at least substantially parallel relation.

28. (currently amended) A method, as claimed in Claim 27, wherein:

said forming a plurality of ~~discrete and at least generally laterally extending hollow~~ conduits step further comprises disposing said plurality of ~~hollow~~ conduits in at least substantially equally spaced relation.

29. (currently amended) A method, as claimed in Claim 1, wherein:

said forming a plurality of ~~discrete and at least generally laterally extending hollow~~ conduits step further comprises directing a first pair of said ~~hollow~~ conduits at least generally toward a first common point and directing a second pair of said ~~hollow~~ conduits at least generally toward a second common point which is different from said first common point.

30. (currently amended) A method, as claimed in Claim 1, wherein:

said forming a plurality of ~~discrete and at least generally laterally extending hollow~~ conduits step further comprises disposing each of said plurality of ~~hollow~~ conduits so as to be at least generally radially extending in relation to a common center.

31. (currently amended) A method, as claimed in Claim 30, wherein:

each of said plurality of ~~hollow~~ conduits terminates at least at generally the same location in proximity to but not at said common center.

32. (currently amended) A method, as claimed in Claim 30, wherein:

a first said ~~hollow~~ conduit extends closer to said common center than a second said ~~hollow~~ conduit.

33. (currently amended) A method, as claimed in Claim 1, wherein:

said forming a plurality ~~of discrete and at least generally laterally extending hollow~~ conduits step comprises forming each of said plurality of ~~hollow~~ conduits in and at least substantially axially extending configuration.

34. (currently amended) A method, as claimed in Claim 1, wherein:

said forming a plurality of ~~discrete and at least generally laterally extending hollow~~ conduits step comprises forming each of said plurality of ~~hollow~~ conduits in other than an axially extending configuration.

35. (currently amended) A method, as claimed in Claim 1, wherein:

said forming a plurality of ~~discrete and at least generally laterally extending hollow~~ conduits step comprises forming each of said plurality of ~~hollow~~ conduits in an at least generally a sinusoidal configuration.

36. (currently amended) A method, as claimed in Claim 1, wherein:

said forming a plurality of ~~discrete and at least generally laterally extending hollow~~ conduits step comprises using a first etchant that is not selective to said first sacrificial layer, and wherein said removing step comprises using a second etchant that is selective to said first sacrificial layer.

37. (currently amended) A method, as claimed in Claim 1, wherein:

said forming a plurality of ~~discrete and at least generally laterally extending hollow~~ conduits step comprises encasing a plurality of etch release rails within said first sacrificial layer and removing said etch release rails without removing said first sacrificial layer.

38. (currently amended) A method, as claimed in Claim 37, wherein:

a stack comprises said first sacrificial layer, said first structural layer, said first substrate, and a first exterior surface that is disposed opposite said first substrate, wherein said method further comprises the step of forming a first runner that is laterally spaced from said first structural layer, that extends from said first exterior surface at least toward said first substrate, and that is interconnected with at least one of said plurality of etch release rails, wherein said removing said etch release rails further comprises first removing said first runner and then each said etch release rail that is interconnected with said first runner.

39. (currently amended) A method for making a surface micromachined microstructure, comprising the steps of:

forming a first sacrificial layer over a first substrate, wherein said first substrate comprises an upper surface that extends in a lateral dimension;

forming a first intermediate layer on said first sacrificial layer and after said forming a first sacrificial layer step;

forming a plurality of first strips from said first intermediate layer that ~~are disposed on and extend at least generally laterally relative to said first sacrificial layer~~extend in said lateral dimension, wherein each said first strip comprises a pair of vertically extending sidewalls, wherein said forming a plurality of first strips step is executed after said forming a first intermediate layer step;

forming a second sacrificial layer on said first sacrificial layer and at least alongside and in interfacing relation with each said sidewall of each of said plurality of first strips, wherein said forming a second sacrificial layer step is executed after said forming a plurality of first strips step;

forming a first structural layer over said second sacrificial layer after said forming a second sacrificial layer step, wherein said first structural layer extends in said lateral dimension and comprises a first perimeter that defines a lateral extent of said first structural layer, wherein said plurality of first strips extend underneath said first structural layer in said lateral dimension such that said first structural layer overlies said plurality of first strips, wherein at least one end of at least one of said plurality of first strips is at a location in said lateral dimension that at least generally corresponds with a location in said lateral dimension of a corresponding portion of said first perimeter; and

removing said first and second sacrificial layers after said forming a first structural layer step, wherein said removing step comprises etching said first and second sacrificial layers, and wherein said etching step comprises ~~etching said second sacrificial layer at a greater rate within each portion of said second sacrificial layer which interfaces with any portion of said first strips in comparison to portions of said second sacrificial layer which are free from contact with any portion of any of said plurality of first strips~~forming a conduit that extends along each said sidewall of each of said plurality of first strips, wherein each said conduit is hollow, embedded, has a closed perimeter that is defined at least in part by said second sacrificial layer, and extends in said lateral dimension.

40. (original) A method, as claimed in Claim 39, wherein:

said forming a second sacrificial layer step further comprises forming said second sacrificial layer on and over each of said plurality of first strips.

41. (original) A method, as claimed in Claim 40, wherein:

said first strips are structural and remain after execution of said removing step, wherein said method further comprises the step of structurally interconnecting said first strips and said first structural layer through said second sacrificial layer and before execution of said removing step.

42. (original) A method, as claimed in Claim 39, wherein:

said first strips are structural and remain after execution of said removing step, wherein said method further comprises the steps of:

planarizing an upper surface of said second sacrificial layer;

etching through said second sacrificial layer to each of said plurality of first strips to define a first interconnect aperture assembly in said second sacrificial layer, wherein said forming a first structural layer step is executed after said etching through said second sacrificial layer step to expose each of said plurality of first strips, and wherein said forming a first structural layer step comprises depositing structural material both within said first interconnect aperture assembly and on top of said second sacrificial layer.

43. (original) A method, as claimed in Claim 42, wherein:

a pattern of said first interconnect aperture assembly in said second sacrificial layer at least generally matches a pattern of said first strips.

44. (original) A method, as claimed in Claim 42, wherein:

said first interconnect aperture assembly comprises a plurality of separate and discrete holes that are disposed in spaced relation to each other.

45. (original) A method, as claimed in Claim 42, wherein:

said plurality of first strips are further disposed in at least one of non-intersecting relation, parallel relation, radial relation, intersecting relation, and any combination thereof.

46. (original) A method, as claimed in Claim 42, wherein:

said planarizing step comprises chemical mechanical polishing.

47. (original) A method, as claimed in Claim 42, wherein:

said forming a first structural layer step comprises forming a depression on an upper surface of first structural layer which is vertically aligned with where said structural material was deposited within said first interconnect aperture assembly, and wherein said method further comprises the step of planarizing said upper surface of said first structural layer.

48. (original) A method, as claimed in Claim 39, wherein:

said forming a plurality of first strips step comprises disposing said plurality of first strips in at least substantially parallel relation.

49. (original) A method, as claimed in Claim 48, wherein:

said forming a plurality of first strips step comprises disposing said plurality of first strips in at least substantially equally spaced relation.

50. (currently amended) A method, as claimed in Claim ~~48~~39, wherein:

said forming a plurality of first strips step comprises disposing a first pair of adjacent said first strips so as to be directed at least generally toward a first common point and directing a second pair of said first strips at least generally toward a second common point which is different from said first common point.

51. (original) A method, as claimed in Claim 39, wherein:

said forming a plurality of first strips step comprises disposing each of said plurality of first strips so as to be at least generally radially extending in relation to a common center.

52. (original) A method, as claimed in Claim 51, wherein:

each of said plurality of first strips terminates at least at generally the same location in proximity to but not at said common center.

53. (original) A method, as claimed in Claim 51, wherein:

a first said first strip extends closer to said common center than a second said first strip.

54. (original) A method, as claimed in Claim 39, wherein:

said forming a plurality of first strips step comprises disposing each of said plurality of first strips in an at least substantially axially extending configuration.

55. (original) A method, as claimed in Claim 39, wherein:

said forming a plurality of first strips step comprises disposing each of said plurality of first strips in other than an axially extending configuration.

56. (original) A method, as claimed in Claim 39, wherein:

said forming a plurality of first strips step comprises forming each of said plurality of first strips in an at least generally sinusoidal configuration.

57. (original) A method, as claimed in Claim 39, wherein:

said forming a plurality of first strips step comprises patterning said first intermediate layer.

58. (currently amended) A method for making a surface micromachined microstructure, comprising the steps of:

forming a first sacrificial layer over a first substrate, wherein said first substrate comprises an upper surface that extends in a lateral dimension, wherein said forming a first sacrificial layer step

comprises forming a plurality of ~~at least generally laterally extending~~ low density regions within said first sacrificial layer that extend in said lateral dimension;

forming a first structural layer over said first sacrificial layer and after said forming a first sacrificial layer step, wherein said first structural layer extends in said lateral dimension and comprises a first perimeter that defines a lateral extent of said first structural layer, wherein said plurality of low density regions each extend in said lateral dimension underneath said first structural layer such that said first structural layer overlies said plurality of low density regions, wherein at least one end of at least one low density region is at a location in said lateral dimension that at least generally corresponds with a location in said lateral dimension of a corresponding portion of said first perimeter; and

removing said first sacrificial layer, wherein said removing step comprises etching said first sacrificial layer using a first etchant, and wherein said etching step comprises etching said plurality of low density regions with said first etchant to define a plurality of conduits that are hollow, embedded, have a closed perimeter that is defined at least in part by said first sacrificial layer, and that extend in said lateral dimension under said first structural layer such that said first structural layer overlies said plurality of conduits, and thereafter retaining said first etchant within said plurality of conduits to etch a remainder of said first sacrificial layer ~~at a greater rate within each of said plurality of low density regions than outside said plurality of low density regions~~.

59. (original) A method, as claimed in Claim 58, further comprising the steps of:

forming a first intermediate layer over said first substrate, wherein said first intermediate layer is disposed between said first sacrificial layer and said first substrate; and

patterning said first intermediate layer into a plurality of first strips, wherein said plurality of first strips are at least generally laterally extending, wherein said forming a first sacrificial layer step

is executed after said patterning step and so as to dispose said first sacrificial layer at least alongside each of said plurality of first strips, wherein said plurality of low density regions exist alongside each of said plurality of first strips.

60. (original) A method, as claimed in Claim 58, further comprising the steps of:

forming a second sacrificial layer over said first substrate;

patterning said second sacrificial layer to define a plurality of at least generally laterally extending apertures, wherein each said aperture comprises first and second aperture sidewalls that are disposed in spaced relation, wherein said forming a first sacrificial layer step is executed after said patterning step such that at least a portion of said first sacrificial layer is disposed within each of said plurality of apertures, and wherein said plurality of low density regions exist along said first and second sidewalls.

61. (original) A method, as claimed in Claim 60, wherein:

said plurality of apertures are disposed in non-intersecting relation.

62. (original) A method, as claimed in Claim 60, wherein:

said plurality of apertures define a network of interconnected said apertures.

63. (currently amended) A method for making a surface micromachined microstructure, comprising the steps of:

forming a first sacrificial layer over a first substrate, wherein said first substrate comprises an upper surface that extends in a lateral dimension;

forming a first structural layer over said first sacrificial layer, wherein said first structural layer extends in said lateral dimension and comprises a first perimeter that defines a lateral extent of said first structural layer; and

removing said first sacrificial layer, wherein said removing step comprises using a first etchant to define at least one etch release ~~channel~~ conduit ~~within~~ that is hollow, embedded, has a closed perimeter that is defined at least in part by said first sacrificial layer, and that extends in said lateral dimension, and thereafter using a second etchant that is different from said first etchant to remove said first sacrificial layer by allowing said second etchant to flow within said at least one etch release ~~channel~~conduit, wherein said at least one etch release conduit extends in said lateral dimension underneath said first structural layer such that said first structural layer overlies said at least one etch release conduit.

64. (original) A method, as claimed in Claim 63, wherein:

said first etchant is not selective to said first sacrificial layer, and wherein said second etchant is selective to said first sacrificial layer.

65. (original) A method, as claimed in Claim 63, further comprising the step of:

encasing a plurality of etch release rails within said first sacrificial layer, wherein said using a first etchant comprises removing said etch release rails without removing said first sacrificial layer.

66. (original) A method, as claimed in Claim 65, wherein:

a stack comprises said first sacrificial layer, said first structural layer, said first substrate, and a first exterior surface that is disposed opposite said first substrate, wherein said method further comprises the step of forming a first runner that is laterally spaced from said first structural layer, that extends from said first exterior surface at least toward said substrate, and that is interconnected with at least one of said plurality of etch release rails, wherein said removing said etch release rails further comprises first removing said first runner and then each said etch release rail that is interconnected with said first runner.

67. (new) A method for making a surface micromachined microstructure, comprising the steps of:

forming a first sacrificial layer over a first substrate, wherein a lateral dimension is at least generally parallel with an upper surface of said first substrate;

forming a plurality of discrete and at least generally laterally extending hollow conduits that are defined at least in part by said first sacrificial layer;

forming a first structural layer over said first sacrificial layer; and

forming a first intermediate layer between said first sacrificial layer and said first structural layer, whereby said first intermediate layer is disposed at least somewhere between said first sacrificial layer and said first structural layer;

patterning said first intermediate layer into a plurality of at least generally laterally disposed and axially extending strips that are disposed in at least substantially parallel and equally spaced relation, wherein a maximum spacing between adjacent pairs of said plurality of strips is about 1.5 microns, and wherein a minimum thickness of each of said plurality of strips is about 1.5 microns;

forming said first sacrificial layer over said first intermediate layer, wherein said forming said first sacrificial layer step fails to fill an entirety of said spacing between said adjacent pairs of said plurality of strips and which thereby defines said plurality of conduits; and

removing said first sacrificial layer, wherein said removing step comprises flowing an etchant within at least some of said plurality of conduits.

68. (new) A method for making a surface micromachined microstructure, comprising the steps of:

forming a first sacrificial layer over a first substrate;

forming a first intermediate layer on said first sacrificial layer;

forming a plurality of first strips from said first intermediate layer that are disposed on and extend at least generally laterally relative to said first sacrificial layer;

forming a second sacrificial layer on said first sacrificial layer and at least alongside each of said plurality of first strips;

forming a first structural layer over said second sacrificial layer; and

removing said first and second sacrificial layers, wherein said removing step comprises etching said first and second sacrificial layers, and wherein said etching step comprises etching said second sacrificial layer at a greater rate within each portion of said second sacrificial layer which interfaces with any portion of said first strips in comparison to portions of said second sacrificial layer which are free from contact with any portion of any of said plurality of first strips, wherein said first strips are structural and remain after execution of said removing step;

planarizing an upper surface of said second sacrificial layer;

etching through said second sacrificial layer to each of said plurality of first strips to define a first interconnect aperture assembly in said second sacrificial layer, wherein said forming a first structural layer step is executed after said etching through said second sacrificial layer step to expose each of said plurality of first strips, and wherein said forming a first structural layer step comprises depositing structural material both within said first interconnect aperture assembly and on top of said second sacrificial layer.

69. (new) A method, as claimed in Claim 68, wherein:

a pattern of said first interconnect aperture assembly in said second sacrificial layer at least generally matches a pattern of said first strips.

70. (new) A method, as claimed in Claim 68, wherein:

said first interconnect aperture assembly comprises a plurality of separate and discrete holes that are disposed in spaced relation to each other.

71. (new) A method, as claimed in Claim 68, wherein:

said plurality of first strips are further disposed in at least one of non-intersecting relation, parallel relation, radial relation, intersecting relation, and any combination thereof.

72. (new) A method, as claimed in Claim 68, wherein:

said planarizing step comprises chemical mechanical polishing.

73. (new) A method, as claimed in Claim 68, wherein:

said forming a first structural layer step comprises forming a depression on an upper surface of first structural layer which is vertically aligned with where said structural material was deposited within said first interconnect aperture assembly, and wherein said method further comprises the step of planarizing said upper surface of said first structural layer.

74. (new) A method for making a surface micromachined microstructure, comprising the steps of:

forming a first sacrificial layer over a first substrate, wherein said forming a first sacrificial layer step comprises forming a plurality of at least generally laterally extending low density regions within said first sacrificial layer;

forming a first structural layer over said first sacrificial layer;

removing said first sacrificial layer, wherein said removing step comprises etching said first sacrificial layer, and wherein said etching step comprises etching said first sacrificial layer at a greater rate within each of said plurality of low density regions than outside said plurality of low density regions;

forming a second sacrificial layer over said first substrate;

patterning said second sacrificial layer to define a plurality of at least generally laterally extending apertures, wherein each said aperture comprises first and second aperture sidewalls that are disposed in spaced relation, wherein said forming a first sacrificial layer step is executed after said patterning step such that at least a portion of said first sacrificial layer is disposed within each of said plurality of apertures, and wherein said plurality of low density regions exist along said first and second sidewalls.

75. (new) A method, as claimed in Claim 74, wherein:

said plurality of apertures are disposed in non-intersecting relation.

76. (new) A method, as claimed in Claim 74, wherein:

said plurality of apertures define a network of interconnected said apertures.